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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Implant for the Intervertebral Space

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Implant for the Intervertebral Space

The invention concerns an implant for the intervertebral space in accordance with the characterizing clause of patent claim 1. Such implants are principally intended to promote bone bridges on vertebral bodies, and are put in place following resection of disks or intervertebral disks between the vertebral body and the spinal column.

It is known that if an intervertebral disk is damaged, it can be removed and the space thereby produced can be filled with cortico-spongiose bone.

With this method, the vertebral bodies are first spread as far apart from each other as possible using a spreader. One special technique consists of placing wedge-shaped pieces - so-called dilators - between the two vertebral bodies, to spread them in step fashion out from each other. In turn, dilators with diameters that increase in each case by 1 mm are alternately inserted from the left and right from the posterior. After the greatest possible spreading has been achieved, the dilators are replaced by the above-mentioned cortico-spongiose bone.

This known technique has a disadvantage in that the bone is difficult to manipulate and bring into the correct position, with corrections nearly impossible. An additional disadvantage of this technique is that in the intervertebral space a rectangular or cylinder-shaped recess must be cut away or milled out, to insert the bone implants between the initially concave sides of the adjoining vertebral bodies. This is complicated, and also causes damage to the vertebral body.

For this, the invention affords a remedy. The invention has the task of creating an implant for the intervertebral space. Based on its specific shape and the method of insertion, it allows an extremely stable locking between the vertebral bodies, without damaging the surface of the bony cover plate of the vertebral body.

An additional task of the invention is to create an implant for the intervertebral space which can be put in without using dilators.

The invention solves the problem with an implant for the intervertebral space which exhibits the features of claim 1.

Additional advantageous configurations of the invention are characterized in the subsequent claims.

The invention-specific implant is equipped with a device for grasping using a tool. Therefore, an external force can be exerted on it with relatively little effort; this makes it possible to move the implant after insertion or take it out again if necessary.

The device for grasping using a tool can be configured as attachment points, so that a rotational force and/or an axial force and/or a lateral force can be exerted on the implant.

At a minimum, these attachment points are shaped in an advantageous configuration in such as way as to allow for the exertion of rotational force on the implant. The implant in this case must have different cross-sectional lengths, so that it will be squeezed to a greater or lesser extent when turned. Or, it can be placed absolutely loosely in its position, so that it can be inserted with no effort between the vertebral bodies, and demonstrate the required positional locking in another position.

In another configuration, the body of the implant in one plane has a lens-shaped, cut-to-size profile, which for the most part corresponds to the dual concave shape of the sagittal section surface of the intervertebral space. In this case the same body in the other plane has principally parallel, flat or only slightly curved sides and a rounded end, so that it can be pressed into the intervertebral space without having to cut away

an insert in the vertebral body, and without damaging the edge of the vertebral body.

The implant is preferably hollow, so that it can be filled with bone material.

To better clarify the invention, several examples of advantageous configurations (to which, however, the invention is not limited) are described in the following, with references to the appropriate drawings.

Shown are:

Figure 1: a schematic representation of two vertebral bodies, which have been spread out away from each other by two dilators.

Figure 2: a cross section along line II-II of figure 1, with a dilator being replaced by a small bone cuboid.

Figure 3: a perspectival view of an invention-specific implant with a tool that can be used with it.

Figure 4: a view in the direction of arrow F4 of figure 3.

Figure 5: a view in the direction of arrow F5 of figure 3.

Figure 6: a cross section along line VI-VI in figure 4.

Figure 7: a schematic depiction of the implant as per figure 3, following insertion between the vertebral bodies.

Figure 8: a schematic depiction of the implant as per figure 3, following insertion between two vertebral bodies and rotation by 90°.

Figure 9: a schematic depiction of an additional configuration of the invention with a tool that can be used with it.

Figure 10: a cross section through an invention-specific implant with one rounded side.

Figure 11: a cross section through an invention-specific implant with two sides rounded across the diagonal.

Figure 12: a cross section through a pairwise arrangement of two mirror-symmetric invention-specific implants.

Figure 13: a schematic depiction of pairwise arranged, mirror-symmetric invention-specific implants, using which the intervertebral disk space can be widened.

Figure 14: a schematic depiction of two implants lying flat in

the intervertebral disk space. These two implants are connected anteriorly by a third implant, before and after rotation into the concave area of the cover plates of the adjoining vertebral bodies.

Figure 15: a perspective view of an invention-specific implant with a longitudinal cut to admit spongy bone material or osteoconductive or osteoinductive material, and transverse perforation of the walls for bone growth.

Figure 16: a perspective view of an invention-specific implant with longitudinally toothed contact surfaces between implant and bone. The longitudinal toothing is configured so that rotation of the implant into the concave space of the cover plates is possible only in one direction.

Figure 17: a perspective view of an invention-specific implant with transversely toothed contact surfaces between implant and bone. The transverse toothing is configured so that one toothing prevents translational motion in the anterior direction, while the other toothing prevents translational motion in the posterior direction. Preventing translational motion in the anterior direction results in pressure removal from the remaining annulus, which, according to the latest research, is innervated, and may react with pain signals to anterior pressure.

The invention, and additional configurations of the invention, will be described in the following in even greater detail, using the partially schematic diagrams of numerous configurational examples.

Using figures 1 and 2, the known technique will first be described.

When an intervertebral disk is removed, as figure 1 depicts, the two adjoining vertebral bodies 1 and 2 are spread as far away from each other as possible, so that dilators 3 can be inserted. After vertebral bodies 1 and 2 are at the desired distance dilators 3, as depicted in figure 2, are replaced by the bone grafts 4. Following the cutting away of a recess in vertebral bodies 1 and 2, these bone grafts 4 must be grafted between the vertebral bodies using a pressure element. It is evident that this technique has the disadvantages named in the introduction to the description.

The invention-specific implant depicted in figure 3-6 overcomes these disadvantages, permitting it to be inserted quickly. In addition, if necessary, it can be locked between two vertebral bodies by applying force. Implant 6 essentially consists of a body 7 with a device 8 to allow grasping using a tool 9. Device 8 for grasping using tool 9 is so configured that rotational, axial and/or lateral force can be exerted on implant 6,

preferably in all directions.

Preferably, as depicted in figures 3-6, device 8 is configured so that at a minimum a rotational force R can be exerted on it. In connection with that, the implant is so configured that it has differing diameters or cross-sectional lengths, so that by turning at the above-named device 8, body 7 of implant 6 can be inserted between vertebral bodies 1 and 2 at greater or lesser distances.

Device 8, as per the 3-6 configuration in figures 3-6, consists of a recess made on the rear axial end 10 of implant 6, in the inner side of body 7. This recess permits tool 9 to be inserted. As shown, the recess may consist of an axially many-sided (such as hexagonal) opening. This allows tool 9 to be used, equipped with a hexagonal end 11 in the form of a socket wrench.

Use of an opening made in the inner side for inserting tool 9, thus the above-mentioned recess, offers the advantage that implant 6 has no protruding disturbing parts.

Preferably, body 7 has a particular form with one or more of the following characteristics:

- The forward axial end 12 of body 7 should be configured to be rounded or wedge-shaped, since this facilitates insertion into

the intervertebral space 25.

- The rounded side 13 on the forward axial end 12 of body 7 preferably runs only along a cross section parallel to the smaller diameter D1 - see figure 4 - and not along the cross section that is at a right angle to it, as depicted in figure 5.

- Sides 14 and 15, through which the smaller diameter runs, are preferably parallel and flat, except for the rounded side 13.

- Viewed from the side, body 7, as depicted in figure 5, has a Rounded-off, lens-shaped profile, and thus a profile that matches the natural dual concave form possessed by an intervertebral space in the sagittal section surface. The transitions between sides 14 and 15 and sides 16 and 17 are rounded off.

- Sides 16 and 17 are preferably at least partially flat, and better if completely flat, along a cross section; the fact that sides 17 and 18 in a transverse direction are at least partially flat offers the advantage that they have stability against tilt in their locked-in state.

- Body 7 has one or more openings or recesses for filling with graft material. As per figures 3 to 6, a straight-through opening 18, extending from side 16 to side 17, is preferred; opening 18 preferably consists of an elongated slit with parallel

Opening 18

walls 19 and 20. The above-named recess 8 can extend to opening 18 if desired.

- Preferably, the implant consists of titanium or a titanium alloy suitable for implants.

- The opening 18 or the slit in body 7 of the implant of figure 3 can be made by drilling several vertical boreholes into body 7 and milling away the intermediate walls.

- Preferably, implant 6, and more precisely body 7, will have a length L of about 22 mm, and will be hollowed out to an approximate wall thickness W1 of 1.5 mm. The rear axial end 10 with device 8 preferably has a minimum diameter of 6 mm. To ensure that the minimum wall thickness W2 at the site of the device 8 and the thickness D of the tool is as large as possible, the above-named recess is made so that the alignment of its greater diameter coincides with the larger diameter of body 7.

Figures 7 and 8 will now be used in the following to describe the use and insertion of implant 6 between vertebral bodies 1 and 2.

Figure 7 depicts how implant 6, on the end of a corresponding tool 9 which resembles a wrench, can be inserted between the two vertebral bodies 1 and 2. Implant 6 is inserted with the smaller diameter D1 between sides 22 and 23 of vertebral bodies 1 and 2

turned toward each other. It is already filled with bone graft material 24. To insert implant 6 between vertebral bodies 1 and 2 so as to fit or lock, wrench 21 of tool 9 is turned by 90°, so that after removal of tool 9, a situation as depicted in figure 8 will result. Since the bone graft material 24 adjoins vertebral bodies 1 and 2, implant 6 can achieve a firm stopping place by coalescence of bone graft 24.

Implant 6 can be inserted with no particular auxiliary aids. However, the procedure can be simplified if the vertebrae are previously spread apart by oval dilators on the left and right side and kept in this position until an implant can be locked in place on the other side. The presence of implant 6 in turn prevents the vertebral surfaces from pressing together again. Therefore, the last dilator can be removed and, if necessary, be replaced by a second implant 6. Normally, two implants 6 must be inserted.

Figures 7 and 8 show clearly that with the use of a turnable implant 6 with different diameters D1 and D2, it can be inserted between vertebral bodies 1 and 2 freely and without difficulty. In addition, it can be brought to a perfect stopping position between the two vertebral bodies by being turned. Therefore, it is not necessary to cut out or mill out the intervertebral space 25 to receive a rectangular or cylinder-shaped recess.

Body 7 of implant 6 has different diameters D1 and D2. Therefore, it is easy to remove from intervertebral space 25. It is clear that following locking in, implant 6 can be loosened by turning it in the opposite direction, until the smaller diameter D1 is between vertebral bodies 1 and 2.

If implant 6 is used that has a body 7 possessing a shape that matches the natural dual concave shape of intervertebral space 25, a perfect fit is automatically achieved between sides 22 and 23 of vertebral bodies 1 and 2 and sides 16 and 17 of implant 6, which is grafted with bone grafts 24.

The technique of turning implant 6 has the following advantages:

- If the cover plates are concave-arched, then rotation allows for the possibility of configuring implant 6 so that in one dimension it is flat, and in the other dimension it matches the geometry of the cover plates. The flat dimension facilitates insertion from the posterior direction; the arched surface affords optimal contact with the cover plates.

- If the cover plates are flat, then the rotation can be used to widen the intervertebral disk space.

- Transverse toothing of the surface of the implant is possible, since the implant is turned only after insertion.

Naturally, implant 6 can be designed in various shapes. In place of a recess for a hex socket wrench, other recess shapes can be used, which may, for example, be rectangular, square or oval openings.

Although device 8 for grasping using tool 9 is preferably made in the inner side of implant 4, this is not absolutely required. It can also consist of a projecting piece or of a particular configuration of the rear axial end 10, so that the projecting piece or the rear axial end 10 can be attached to a suitable tool, so that the required force can be exerted.

According to another configuration of the invention, device 8 is not exclusively designed to allow rotational force to be applied, but rather also axial force. Indeed, both a compressive and a tensile force can be exerted, so that, if necessary, implant 6, when being inserted between vertebral bodies 1 and 2 can be pressed in. If the need arises to withdraw it again, tensile force can be exerted. Thus, at any time it is possible to remove implant 6 during the operation.

Such a configuration is depicted by figure 9. Device 8 combines a first attachment element 26, which permits exertion of rotational force, with a second attachment element 27, which allows for the exertion of axial compression and tensile force on implant 8, and for this purpose it is equipped with an axial

stop.

The first attachment element 26 consists of a recess as in the configuration depicted in figure 3. The second attachment element 27 consists of an additional recess, such as in the form of a slit in the wall of the above-mentioned hexagonal opening, into which the locking element 28 of the tool 9 in question can grip. As shown in figure 9, the locking elements 28 consist of balls or the like. After the hexagonal end 11 of tool 9 has been inserted into the hexagonal recess, these locking elements 28 press radially outwards and lock into the above-mentioned slit.

Tool 9 can have various shapes and be operated in various ways. In accordace with figure 9, it is controlled by means of a shifter grip 29 combined with a wedge 30, which in turn presses the locking elements away from each other or loosens them.

In another variation, the wrench end is split. The exterior diameter can be increased by applying pressure or screwing an interior pin, so that the wrench can be locked into the opening of implant 6 into which it is inserted.

In still another variation, also on the front axial end 12 with the rounded side 13 of implant 6, attachment possibilities can be provided for tool 9. These attachment possibilities can be of different types, and are preferably configured so that, just as

with device 8, they allow for the application of rotational force, axial force and/or lateral force onto implant 6. The attachment options consist of a many-sided (hexagonal, for example) opening, allowing insertion of a wrench with an appropriate end piece, so that torsional force can be exerted on implant 6, if it has not grown sufficiently into place and must be removed in the abdominal direction. This invention naturally also concerns to implant 6, which is equipped at one end with an attachment device that enables attachment of the implants in the abdominal direction.

Figures 10 and 11 depict invention-specific implants having a partially rounded cross section.

Figure 10 shows the body 7 of implant 6, with a rounded side 31 on the upper edge of the front axial end 12. The radius of the rounded side on one side 31 is measured in such a way that a) the difference between the larger side of the rectangular cross section and the diagonal via the rounded edge is less than 3 mm, preferably 1-2 mm. Also, b) the smaller surface is reduced by less than half, and preferably by less than a third, i.e. the carrying surface should correspond at a minimum to 2/3 of the overall width of the implant.

Figure 11 shows the body 7 of implant 6 in cross section, with the implant having rounded sides 23 across the diagonal on each

side in cross section. The radii of the opposite rounded sides 32 are measured in such a way that a) the difference between the longer side of the cross section and the diagonal across the rounded edges is less than 3 mm, preferably 0.5 - 1.0 mm. Also, b), the shorter side of the implant is reduced by less than half, and preferably by less than a third.

Figure 12 depicts two pairs of implants 6, symmetrically placed along the axis of symmetry 33. The upper pair of implants 6 in section (a) are depicted as per figure 10, while the lower pair of implants 6 in section (b) are depicted as per figure 11.

When erecting (rotating) an implant as shown in figure 6, the intervertebral space 25 is overstretched by about 3-4 mm, which can cause the cover plates to break and can lead to permanent overstretching of the connective tissue. If the edges are rounded (31, 32), overstretching is greatly reduced, but this, however, reduces the stability of the straightened implants. Or, the paired implants are arranged to be mirror-symmetric, to mutually stabilize each other (see figure 13).

Erection using two implants 6 which have rounded sides 31 and 32 with suitably selected radii, results in overstretching of the intervertebral space by only 1 mm. However, the individually set up implants 6 are not too stable. They can tilt back as easily as they were erected. In figure 13, the two implants 6 are

mutually protected by their mirror-symmetric geometry from tilting, since the implants 6 can tip only as a pair and not individually.

Figure 13 shows two mirror-symmetrically arranged implants 6 in accordance with figure 11. The rounded sides 32 of body 7 lie symmetrically to each other. Following insertion, the bodies 7 of implants 6 lie horizontally between vertebral bodies 1 and 2. They can then be rotated using a suitable tool 9 by 90° into the position 7' drawn in black, to expand the intervertebral space 25. The rectangular cross section of body 7 is created in such a way that following rotation of implant 6 by 90°, into the concave space of the cover plates of the adjoining vertebral bodies 1 and 2, there is a residual widening of the intervertebral space 25 of between 1 and 4 mm, preferably between 2 and 3 mm.

Figure 14 shows two implants 6, lying flat in intervertebral space 25 (plane of the drawing). These are linked in anterior fashion with each other by a connector 34. The left side of figure 14 depicts the position before rotation of implant 6. The right side of figure 14 shows the placement after rotation by 90° into the concave area of the cover plates of adjoining vertebral bodies.

The posterior end of implant 6 remains free, and is linked only by connector 34 in anterior fashion, so that (a) the distance

between the right and left implant 6, and their orientation, is kept in place. Also (b), implants 6 are able to be turned about their longitudinal axis 35. In addition (c), the two implants 6 can be coupled prior to implantation and/or in situ by connector 34.

Figure 15 shows an implant 6 with a longitudinal cutout 36 to admit spongy bone material or osteoconductive or osteoinductive material. It also has transverse perforations 36 of its walls for bone growth. Preferably, the diameter of perforations 36 is designed in such a way that (a) cancellous bone pressed into longitudinal cutout 36 does not escape from the sides. Also (b), upon filling implant 6, the fluid contained in the cancellous bone is able to escape out the sides and then diffuse back following implantation, to effect a postoperative swelling of the cancellous bone. Also (c), bone can grow into implant (6) through the perforations 37.

Figure 16 shows an implant 6, whose contact surfaces between implant 6 and the bone are equipped with a longitudinal toothing 38. The longitudinal toothing 38 is preferably configured in such a way that rotating the implant 6 into the concave space of the cover plates is possible only in one direction, as indicated by arrows 39, 40.

Figure 17 shows an implant 6 whose contact surfaces between

implant 6 and the bone are equipped with a transverse toothing 41. Preferably, the transverse toothing 41 is configured in such a way that it prevents the one contact surface from making translational motion in the anterior direction, while it prevents the other contact surface from making a translational motion in the posterior direction, as shown by arrows 42, 43. Prevention of translation in the anterior direction causes a removal of pressure on the remaining annulus, which, according to the latest research, is innervated, and thus could react with pain signals to anterior pressure.

In no way is this invention limited to the examples given and the models depicted in the illustrations. Such dilators and the accompanying tool can take various shapes and sizes, without falling outside the framework of the definitions which are given in the summary in the appendix.

Patent Claims

1. An implant (6) for the intervertebral space (25) is characterized in that it consists of an essentially cuboid-shaped body (7) with a device (8) for gripping with a tool (9).

2. The implant according to claim 1 is characterized in that device (8) is designed in such a way that it allows for the exertion of a rotational force on implant (6).

3. The implant according to claim 1 or 2 is characterized in that device (8) consists at least of a recess on the inner side of body (7), into which the tool (9), preferably similar to a wrench, can be inserted.

4. The implant according to claim 3 is characterized in that the recess consists of an interior hexagon in the inner side of body (7).

5. The implant according to one of claims 1 to 4 is characterized in that the device (8) is so configured that at a minimum, exertion of axial, compressive or tensile force is possible on implant (6).

6. The implant according to one of claims 1 to 5 is characterized in that it has a device (8) in the form of an inner recess to

admit a tool (9), and that in the recess two attachment elements (27) are provided, with an axial locking for the tool (9).

7. The implant according to one of claims 1 to 6 is characterized in that device (8) is so configured that at a minimum it is possible to exert lateral force on implant (6).

8. The implant according to one of claims 1 to 7 is characterized in that it has different diameters (D1, D2).

9. The implant according to claim 8 is characterized in that the sides (14 and 15), between which the smaller diameter (D1). extends, are for the most part parallel and flat.

10. The implant according to claim 8 or 9 is characterized in that implant (6) has a rounded-off, lens-shaped profile on the longitudinal section of the larger diameter (D2).

11. The implant according to claim 10 is characterized in that the sides (15, 16) which enclose the rounded-off, lens-shaped profile are at least partially flat in the direction transverse to implant (6).

12. The implant according to one of claims 1 to 11 is characterized in that at least one of its axial ends (10; 12) is rounded off.

13. The implant according to one of claims 1 to 12 is characterized in that body (7) has one or more openings (18) to be filled with graft material (24), with the openings being placed in such a way that the graft material (24) touches the vertebral bodies (1, 2) in the final position of implant (6).

14. The implant according to one of claims 1 to 13 is characterized in that implant (6) is provided with a straight-through opening (18), having the shape of an elongated groove with parallel walls (19, 20).

15. The implant according to one of claims 1 to 14 is characterized in that it is equipped on two of its ends with the devices (8, 26).

16. The implant according to one of claims 1 to 15 is characterized in that it is made of titanium or a titianium alloy.

17. The implant according to one of claims 1 to 16 is characterized in that it has a rectangular cross section with one side rounded (31).

18. The implant according to claim 17 is characterized in that the radius of the one rounded side (31) is measured in such a way that

a) the difference between the longer side of the rectangular cross section and the diagonals across the rounded edge is less than 3 mm, preferably 1-2 mm;

b) because of the rounding (31), the contact surface to the bone is reduced by less than half, preferably by less than a third.

19. The implant according to one of claims 1 to 18 is characterized in that it has a rectangular cross section with two rounded sides (32) across the diagonal.

20. The implant according to claim 19 is characterized in that the radii of the two rounded sides (32) is measured in such a way that

a) the difference between the longer side of the cross section and the diagonal across the rounded edges is less than 3 mm, preferably 0.5-1.0 mm, and

b) the smaller surface of the implant is reduced by less than half, preferably by less than a quarter.

21. The implant according to claim 19 or 20 is characterized in that it is configured in such a way that when such implants are arranged in pairwise fashion, their rounded edges come to lie symmetrically to each other.

22. The implant according to one of claims 19 to 21 is characterized in that it has a rectangular cross section, designed in such a way that after rotation of the implant into the concave space of the cover plates of the adjoining vertebral bodies, a widening of the intervertebral space (25) of between 1 and 4 mm, preferably between 2-3 mm, remains.

23. The implant according to one of claims 19 to 21 is characterized in that it has a cross section which is reduced to a square, and that following rotation of the implant into the concave space of the end plates of the adjoining vertebral bodies, no widening of the intervertebal space (25) remains

24. The implant according to one of claims 19 to 22 is characterized in that the posterior end of implant (6) is designed in such a way that a left and right implant can be connected anteriorly by a connector (34) in such a way that

(a) the the distance between the left and right implant (6), and their orientation, are maintained;

(b) implants (6) can be turned about their longitudinal axis (35); and

(c) the two implants (6), prior to being implanted and/or in situ, can be linked by means of connector (34).

25. The implant according to one of claims 19 to 22 is characterized in that it is designed in such a way that prior to being implanted or in situ, it can be interlocked with a second implant (6), with the link

(a) maintaining the distance and angle between the implants (6); and

(b) permitting rotation of implants (6) about their longitudinal axis (35), into the concave space of the cover plates of the adjoining vertebral bodies (1, 2).

26. The implant according to one of claims 19 to 22 is characterized in that it is designed in such a way that following rotation about its longitudinal axis (35) into the concave space of the cover plates, it can be connected in angularly stable fashion medially via an additional implant.

27. The implant according to one of claims 19 to 26 is characterized in that its surface is coated, preferably by hydroxyl apatite or titanium plasma.

28. The implant according to one of claims 13 and 14 and one of claims 19-27 is characterized in that it has perforated walls, with the perforations (37) preferably hole-shaped and the diameter of the holes designed so that

(a) cancellous bone pressed into the longitudinal opening does not come out of the sides, and

(b) the fluid contained in the cancellous bone can come out of the sides when the implants are plugged and diffuse back following implantation, to cause a postoperative swelling of the cancellous bone; and

(c) bone can grow through the perforation into the implant.

29. The implant according to one of claims 19-28 is characterized in that one of the contact surfaces between the implant and bone has a toothing in the longitudinal direction of the implant.

30. The implant according to one of claims 19-28 is characterized in that both contact surfaces between the implant and bone have a toothing in the longitudinal direction of the implant.

31. The implant according to one of claims 29 or 30 is characterized in that the geometry of the toothing permits rotation of the implant in one direction and prevents it in the other direction.

32. The implant according to one of claims 19-28 is characterized in that one of the contact surfaces between the implant and bone has a transverse toothing.

33. The implant according to one of claims 19-28 is characterized in that both contact surfaces between the implant and bone have a transverse toothing.

34. The implant according to one of claims 32 or 33 is characterized in that the geometry of the toothing prevents displacement of the implant in the anterior direction.

35. The implant according to one of claims 32 or 33 is characterized in that the geometry of the toothing prevents displacement of the implant in the posterior direction.

36. The implant according to claim 32 is characterized in that the geometry of the toothing of both contact surfaces between the implant and bone is configured in such a way that one toothing prevents a displacement of the implant in the anterior direction, and the other toothing prevents a displacement in the posterior direction.

37. The implant according to one of claims 29 or 32 is characterized in that it has a longitudinal toothing on one of the contact surfaces and a transverse toothing of the other contact surface.

38. The implant according to one of claims 32-35 or 37 is characterized in that the transverse toothing of the individual

contact surfaces is designed in such a way that displacement is prevented in the posterior and anterior direction.

39. The implant according to one of claims 13 and 14 and one of claims 19-17 and 29-38 is characterized in that the walls (19) and (20) have transverse slits.

40. The implant according to claim 39 is characterized in that the hollow spaces and slits are filled with an osteoconductive or osteoinductive material, preferably hydroxyl apatite, so that bone from the cover plates of the adjoining vertebral bodies and from the sides can grow in.

41. The implant for the intervertebral space (25) with

a) an essentially cuboid shape with edge lengths a,b,c;

b) a front axial end surface (12) and a rear axial end surface (10), which is intersected by a longitudinal axis (35);

c) two side surfaces (14, 15) which are intersected by a transverse axis (44); and

d) a top surface (16) and an underside (17) which are intersected by a transverse axis (45);

is characterized in that

e) implant (6) has a device (8) for gripping by a tool (9); and

(f) the front axial end surface (12) and/or the rear axial end surface (10) are configured to be rectangular.

Summary:

The implant (6) for the intervertebral space (25) consists of an essentially cuboid body (7) with a device (8, 26) for gripping by a tool (9).

(Figure 3)

Abstract of the Disclosure

An implant for the intervertebral space consists of an essentially cuboid body with a device for gripping by a tool.

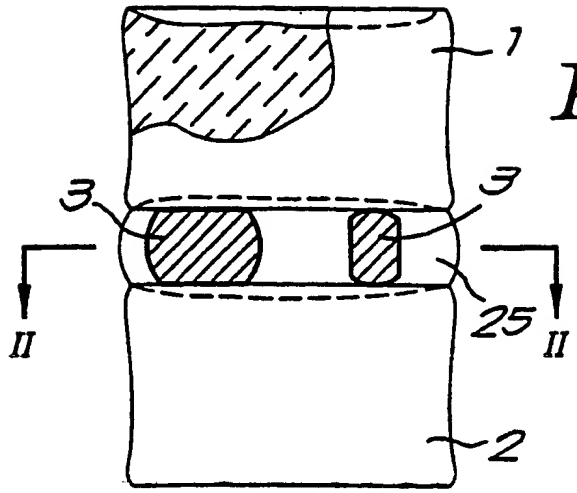

Fig.1

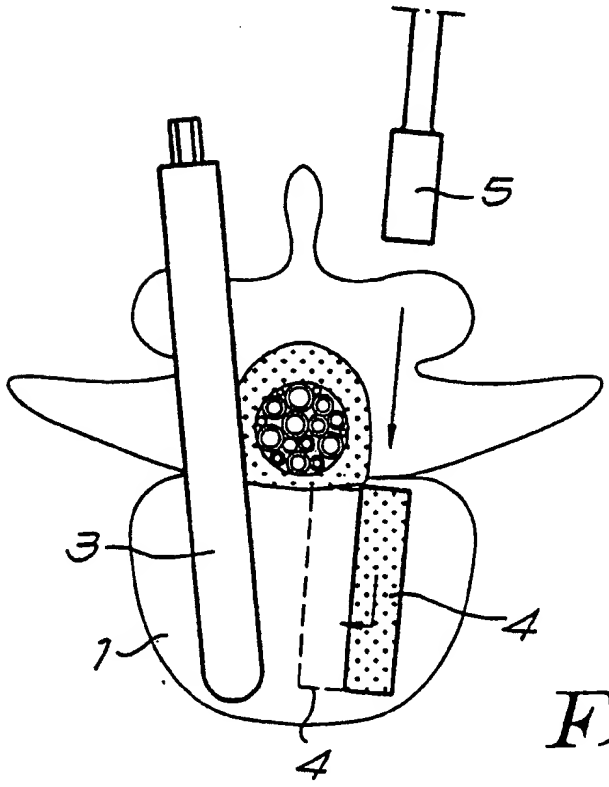

Fig.2

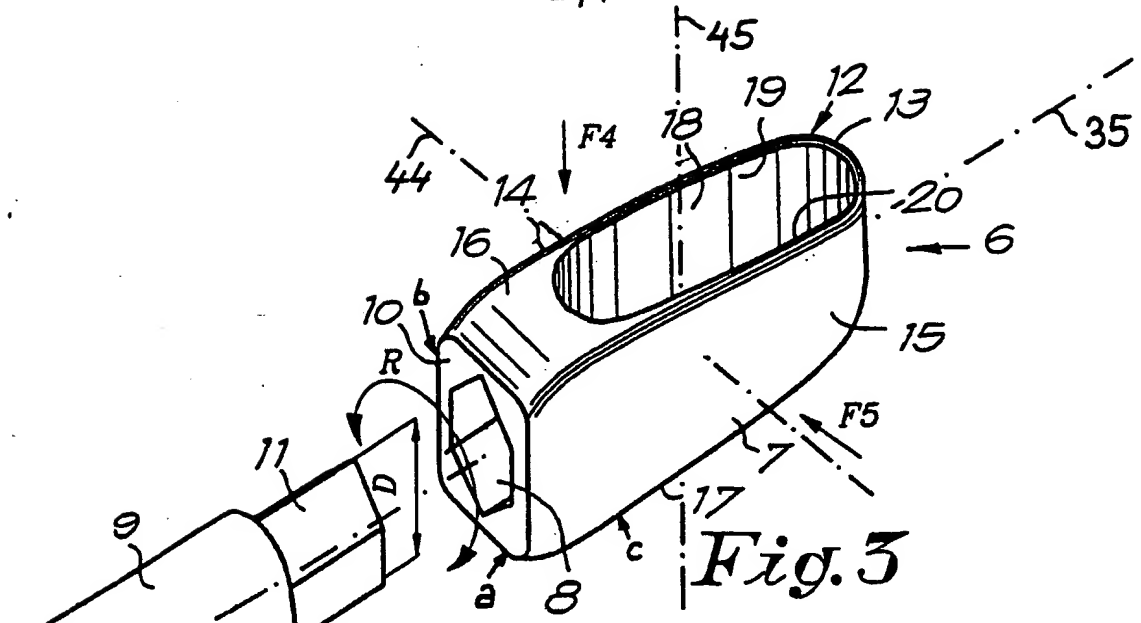

Fig. 3

Fig. 4

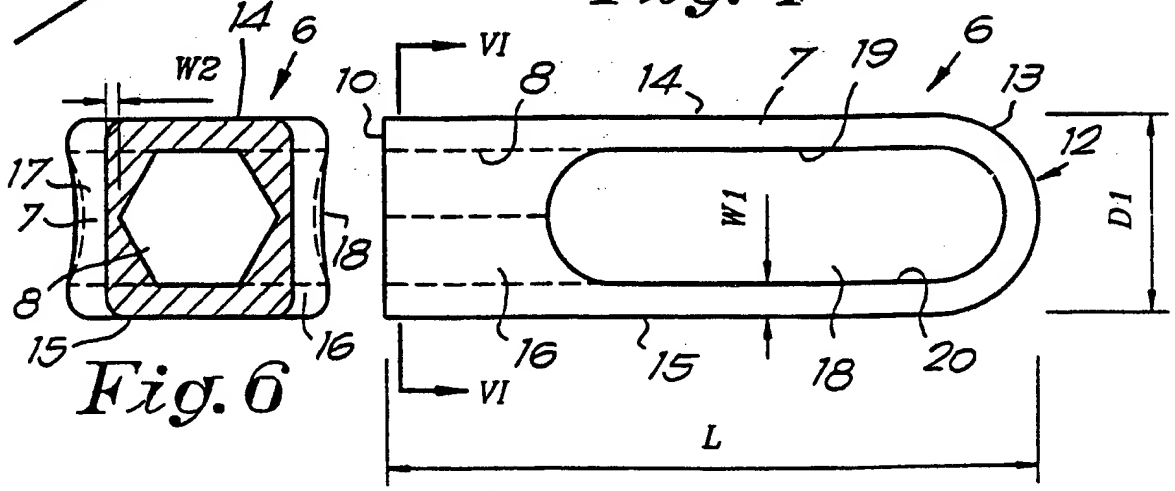

Fig. 6

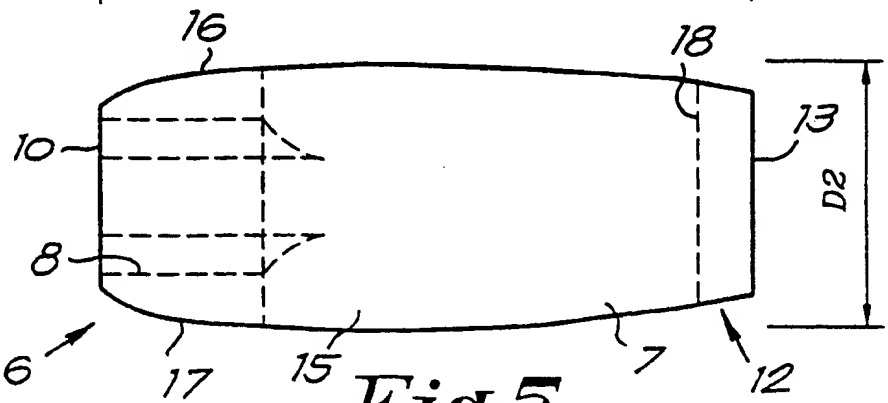

Fig. 5

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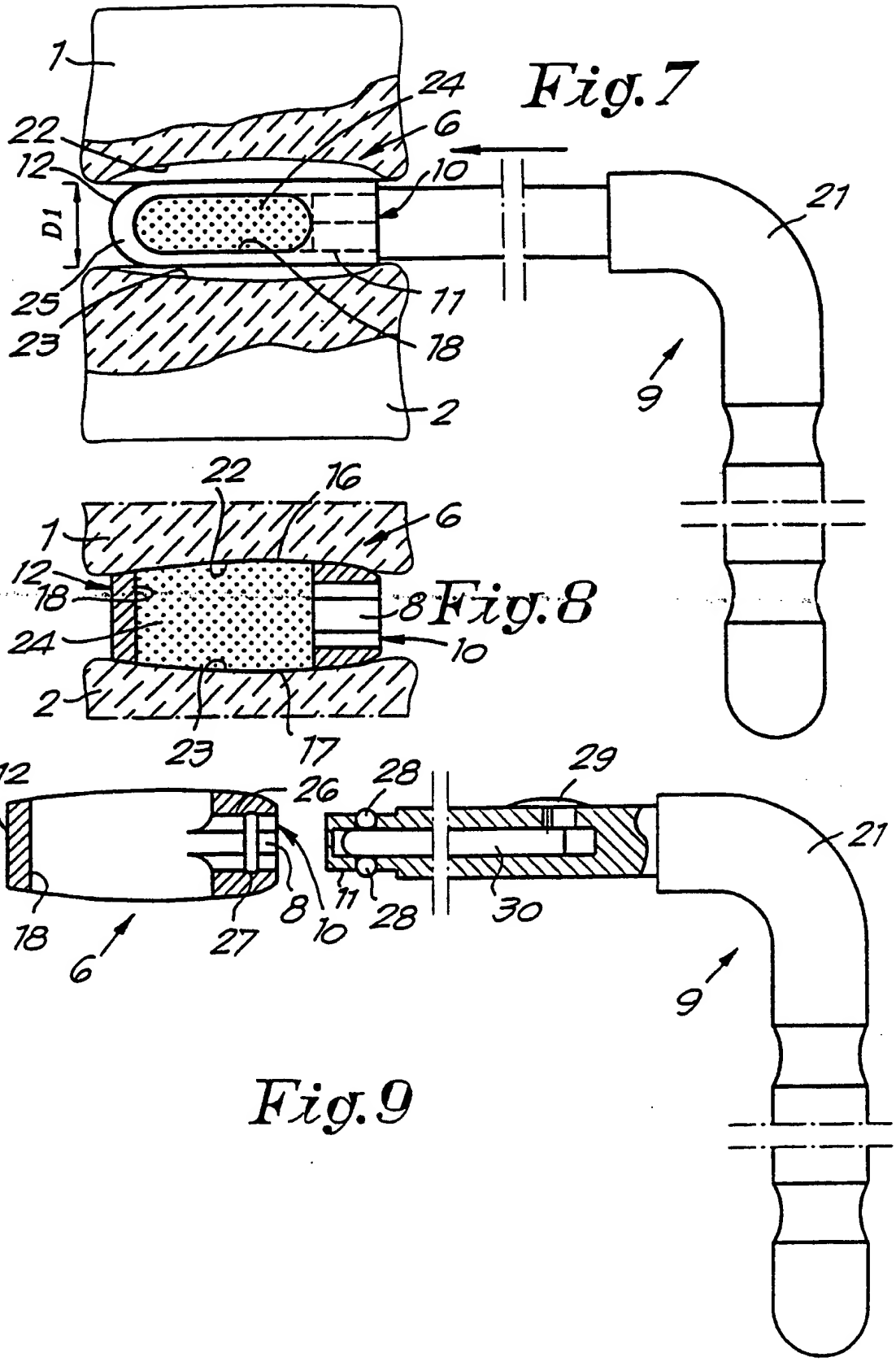

Fig.7

Fig.8

Fig.9

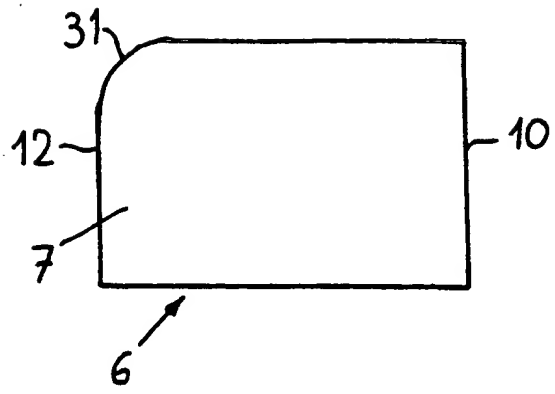

Fig. 10

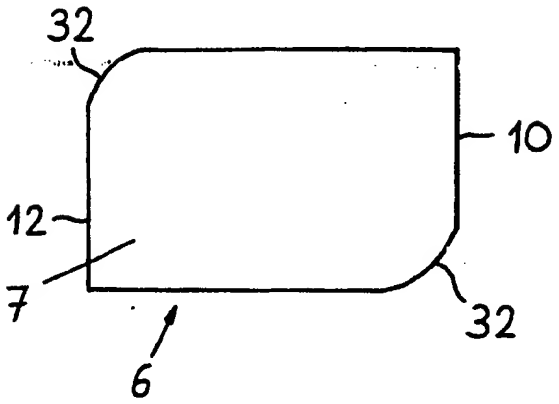

Fig. 11

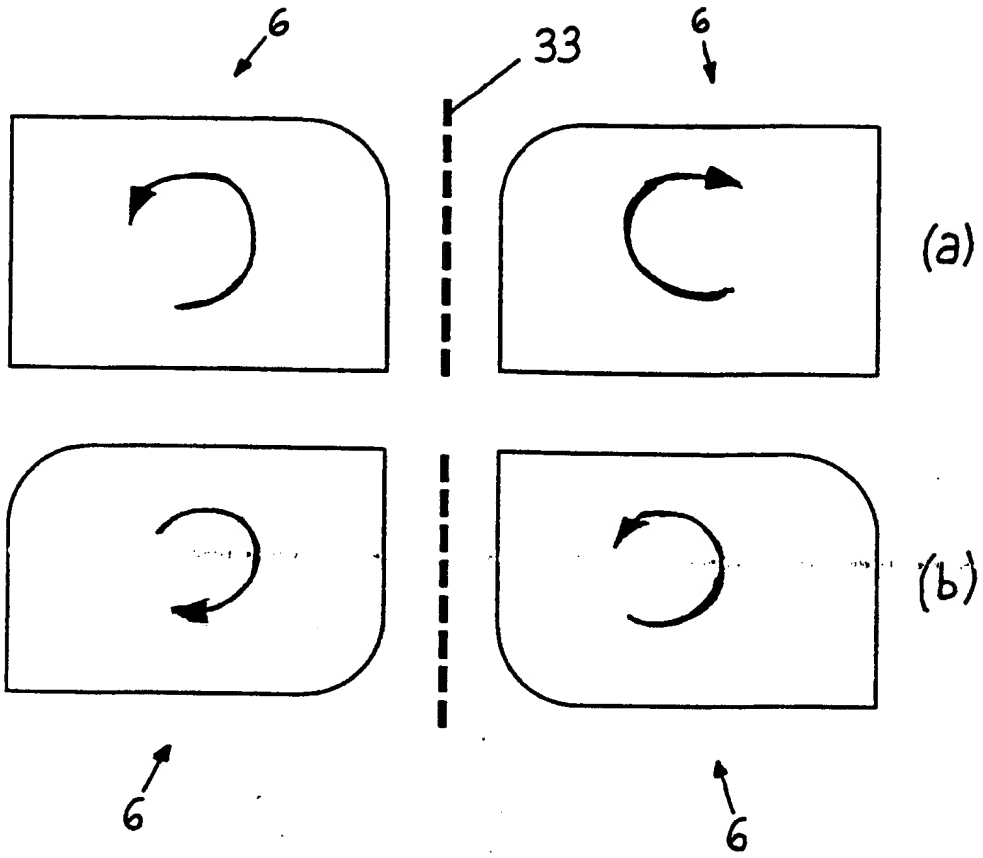

Fig. 12

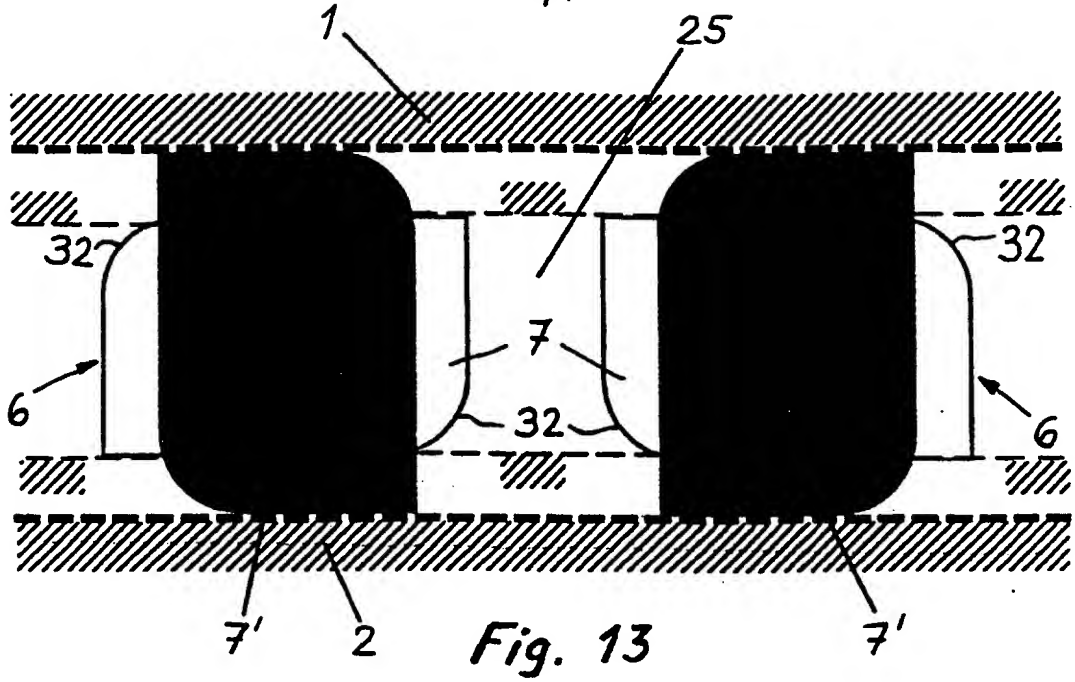

Fig. 13

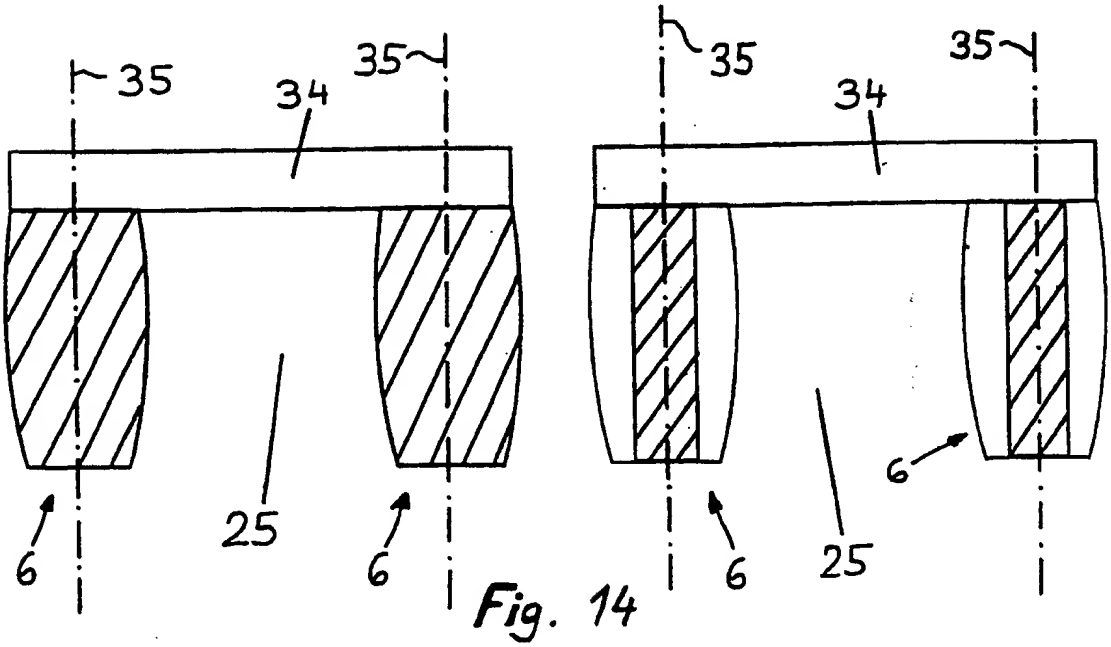

Fig. 14

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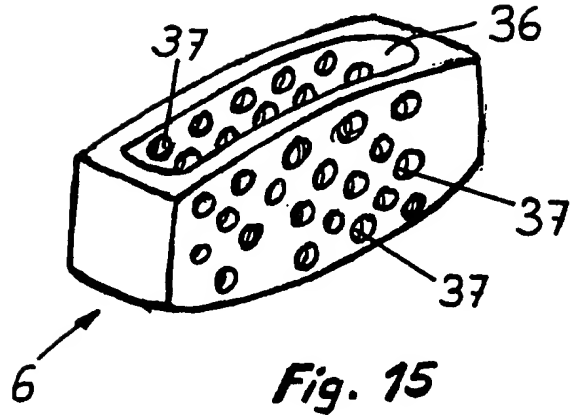

Fig. 15

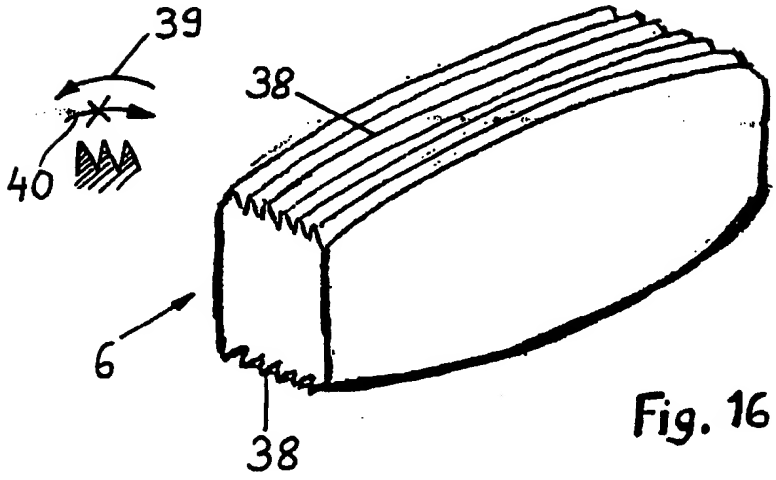

Fig. 16

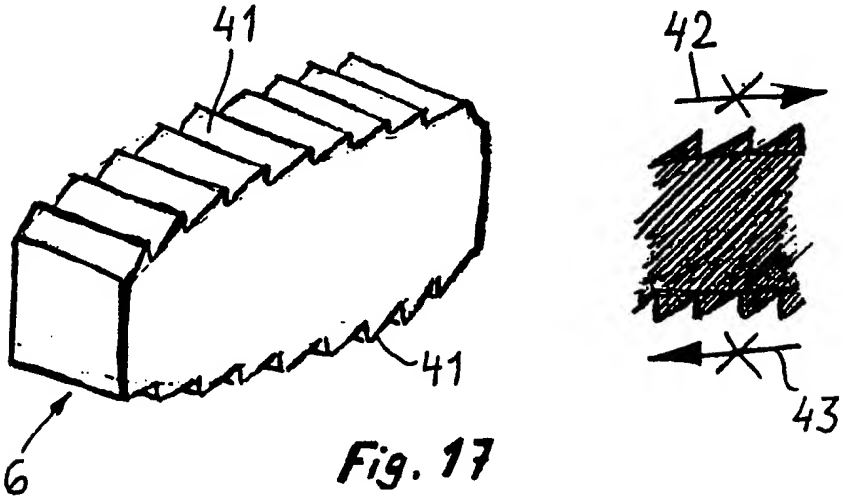

Fig. 17